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The Chemical Research Development and Engineering Center (CRDEC) has experienced dudding problems with the M825A1 white phosphorous (WP) projectile during lot acceptance testing (LAT). An investigation of the data revealed changes in the burster and the M739/M739A1 safing and arming (S&A) module. The Armaments Research, Development and Engineering Center (ARDEC), Fuze Division, was tasked to evaluate the S&A Evaluation of hardware, tolerance studies, spin tests, and functioning tests were conducted Based upon there results, it was concluded that the S&A is highly unlikely to have caused the malfunction.

14 SUBJECT TERMS			15 NUMBER OF PAGES
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M825A1	M739 safe and arm	Fuze, PD, M739 series	
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CONTENTS

FIGURES

INTRODUCTION

The Chemical Research Development and Engineering Center (CRDEC) has experienced two M825A1 white phosphorous (WP) projectile malfunctions during lot acceptance testing (LAT) at Dugway Proving Ground (DPG). An expeditious investigation of the hardware data revealed that the lot contained bursters and safing and arming (S&A) modules with an interfix number change. The burster interfix change was the result of contract administration, not hardware changes. The S&A interfix change was the result of S&A manufacturer change. This was the first lot of M825A1 using S&A manufactured by a new vendor. An examination of the recovered M825A1 hardware at DPG revealed that both S&A fully armed and functioned high order. The examination also revealed evidence that the bursters that expel the WP did not detonate.

The Armaments Research, Development and Engineering Center (ARDEC), Fuze Division was tasked to evaluate the S&A in order to see if it could contribute to the malfunctions. Evaluation of the recovered hardware, tolerance studies, spin tests, and functioning tests conducted indicated correct S&A functioning. Based on these results it was concluded that the S&A is highly unlikely to have caused the malfunctions.

DISCUSSION

M825A1 Failures

The two malfunctions experienced by CRDEC occurred at zone 8 during lot acceptance testing (LAT) conducted at Dugway Proving Ground (DPG), Utah on 20 December 1989 and 22 January 1990. The same projectile lot (PB-89J000E005) was retested on 13 March 1990 during which two additional canister malfunctions occurred at zone 8. One canister was seen as a streamer (WP smoke trail from ejection to ground). The second canister was a dud. Both canisters were recovered by Explosive Ordnance Disposal Personnel (EOD) at DPG.

Examination of the recovered canisters revealed evidence that the S&A module fully armed and functioned (fig. 1). The detonator and lead functioned, and the dimension of the output hole on the S&A bottom plate shown on figure 1 are:

Streamer - 0.4 in. x 0.3 in., measured 90 deg apart
Dud - 0.42 in. x 0.48 in., measured 90 deg apart

Examination of the burster in the dud unit showed that the composition (Comp) A-5 explosive did not detonate (fig. 2); however, approximately 1 in. of the Comp A-5 was missing. The burster well and burster were mangled as shown on figure 3. Metal parts examination of the streamer showed evidence of Comp A-5 burning rather than detonating. Both rounds did not function high order as intended.

Hardware Data

Examination of hardware manufacturing data related to the malfunction revealed changes in the burster interfix and the S&A manufacturer. The burster interfix change was related to a change in the administration of the contract to AMCCOM (Armament Munitions and Chemical Command, Rock Island Arsenal) from CRDEC. The S&A change was the result of a new manufacture for the item. These units were manufactured by Action Manufacturing Company. Rounds manufactured prior to this lot contained S&A supplied by Rexon Technology. Action S&A were also related to an M739A1 fuze lot (AKT88H001-010) which was initially rejected due to excessive delay mode duds. Piece part examination of M739A1 fuzes revealed that the fuze failures were due to the impact delay module (IDM) in the fuze. This component is not used in the M825/M825A1 smoke round. Fuzes functioning on subsequent impact (FSI) were labeled as duds. The FSI were caused by the IDM in the fuze, not by the S&A mechanism; all the S&A armed and functioned. Engineering changes were implemented as a result of the fuze lot failure investigation which modified the metal parts fuze specification (MIL-F-63518) and no longer classifies an FSI as a dud. The status of the fuze lot was therefore changed from rejected to accepted. The technical data package (TDP) does not specify a LAT for the S&A, however, the procurement of the S&A is incorporated into the fuze contract. An unspecified procurement policy requires the contractor to manufacture the S&A between two consecutive fuze lots which must pass metal parts LAT as outlined in the metal parts fuze specification. This requirement was met by Action Manufacturing; therefore, the S&A used in the failed M825A1 met the metal parts acceptance requirement.

S&A Tests

ARDEC was requested by CRDEC to conduct tests as outlined in appendix A in order to determine possible S&A contribution to the problem. The effort included a tolerance study and functioning tests.

Tolerance Analysis

The study focused on horizontal and vertical tolerances between the burster, S&A, and front plate assembly. The study of the horizontal tolerances revealed that the burster and the well may be off center by a maximum of 0.01975 in. It also revealed that the burster and the well may have a maximum side gap of 0.020 in. However, the PA-508 (S&A output lead) is always covering 100% of the Comp A-5 in the burster (fig. 4). Therefore, there was no need to examine this further. The vertical tolerances revealed that a maximum gap between the S&A output and the Comp A-5 is 0.015-in. minimum and 0.17-in. maximum. The maximum gap was determined by assuming that the felt disc is not assembled. An illustration is presented in figure 5. These data were provided to the ARDEC Energetics Division for their gap testing. Their test results showed that this gap variation has no effect on the S&A to burster output.

Spin and Functioning Tests

Tests were conducted on 15 S&A in order to determine if the S&A provides sufficient output to function the burster. Ten S&A were manufactured by Action Manufacturing and five were manufactured by Rexon Technology. All 15 were spun at 2,000 rev/min and fully armed. This is well below the spin of 11,505 rev/min which is produced by the gun under the malfunction conditions. This test indicates that the S&A have experienced sufficient spin to fully arm. Furthermore, the DPG recovered units were also fully armed.

The 15 S&A were then manually resafed and transported for explosive testing in order to evaluate and compare the damage to the burster well and the S&A. Each S&A was manually rearmed prior to the test. The test data are located in appendix B for review. Eight of these were tested as specified by CRDEC using inert aluminum rods with varying cavities (0.070 in. to 0.090 in.). These rods were used in place of the burster in order to see if the S&A has sufficient output to deform the cavity. After functioning the eight S&A, it was observed that the aluminum rods had fused with the burster well. The S&A therefore have sufficient energy to deform the deepest cavity (0.090) inert aluminum rod.

Output Tests

One S&A (manufactured by Action) was used for testing the output of the lead, PA-508. The boostered fuze specification (MIL-F-63519) requires that the lead output blow a minimum 0.210 in. through the hole in a 1/8-in. thick lead disc for a high order function. The S&A tested blew a 0.311 in. by 0.317 in. through the hole. Furthermore, LAT data on the leads used by Action and Rexon showed no failures (app C). This indicates that the S&A exceeded the minimum damage requirement.

One S&A was assembled into the empty well, i.e., no burster was used. This test was to evaluate the damage caused by the S&A alone and to establish a reference for S&A output comparison. The burster well absorbed no damage. The damage to the S&A (fig. 6) was similar to the DPG recovered units. The DPG units had a jagged output hole; whereas, this unit had a clean output hole. This is due to the fact that no obstruction or explosive material was in direct contact with the S&A. This would normally cause additional damage to the S&A.

Malassembly

One S&A was placed upside down over the burster to simulate malassembly of the canister. An M1A1 electric squib was placed over the pyrotechnic delay element in order to simulate normal functioning of the delay element by a fuze. The M1A1 squib was initiated in order to function the lead (PA-508). The PA-508 sustained damage (fig. 7); however, it did not propagate to the stab detonator (M55) or the burster. This S&A was later destroyed by functioning the stab detonator which yielded identical S&A damage to the lead output tests. This clearly shows that the S&A in the recovered DPG unit could not have been installed upside down.

Five S&A, manufactured by Action, were functioned with bursters. One unit had a cocked S&A placed over the burster; two units were assembled with upside down bursters. These orientations were to simulate and evaluate the output of the S&A with various malassemblies. One unit was properly assembled so as to establish a comparison.

The unit used for the cocked S&A test yielded an output hole dimension of 0.525 in. by 0.496 in., measured 90 deg apart. An adapter was fabricated to ensure that the S&A remained in a tilted position. The gap between burster and the S&A lead was set at a maximum by placing a 0.017-in. shim. the felt disc was also removed from the burster in order to provide a vertical gap. This configuration is illustrated in figure 8. The S&A functioned the burster high order (fig. 9). The S&A output hole was measured to be 0.460 in. by 0.430 in., 90 deg apart. This damage was similar to the DPG recovered units. This penalty test clearly indicates that the S&A used in the M825A1 failures provided sufficient output to function the burster.

Two S&A were assembled with upside down bursters. The felt disc was removed and the burster was inserted with the green end down. These units functioned high order and the S&A had larger output hole dimensions when compared to the properly assembled test unit (fig. 10). The upside down bursters yielded an S&A output hole of 0.494 in. by 0.571 in. and 0.473 in. by 0.709 in. It also yielded larger front plate assembly hole dimensions when compared to the properly assembled unit.

CONCLUSION

Based on the results of the tests, it is clear that the saving and arming used in the malfunctioned M825A1 projectiles have not contributed to the failures. Tests show that under worst case scenarios using gaps and malassembled units. sufficient energy to function the burster high order was obtained It was also interesting to note that the upside down bursters yielded the best output. This may be related to the manufacture of the burster. The Comp A-5 in the burster is recessed by a minimum of 0.07 in. and a maximum of 0.09 in. at the top while flush at the bottom. This indicates that a more controlled pressing is required at the top of the burster.

RECOMMENDATIONS

The U.S. Army Armament, Research and Development (ARDEC) Fuze Division recommends that the following areas be addressed by Chemical Research Development :

1. During the course of the investigation it was discovered that an unspecified procurement policy requires the contractor to manufacture the safe and armings (S&A) in between two consecutive fuze lots which must pass metal parts lot acceptance testing (LAT) as outlined in the metal parts fuze specification. This office recommends that CRDEC initiate action to require that this policy be documented by AMCCOM, Rock Island, on future S&A procurements. Even though the S&A involved in the malfunction adhered to this undocumented policy, this office feels that a potential for procuring S&A outside this policy exists.

2. The S&A is held in place by a retainer in the M825A1 assembly. No height checks or requirements are placed on this assembly to ensure proper alignment of the S&A. This office feels that this is a critical area and should be controlled. Measurements of the retainer heights under various conditions, while conducting the tests, have been recorded. These data may be used as guidance by CRDEC in implementing height requirements and checks.

3. The current design of the S&A retainer for the M825A1 has right hand threads. It is felt that this poses a possibility of unscrewing the retainer during firing thereby loosening the S&A which may result in duds. Even though the Dugway Proving Ground recovered units did not experience this, this office strongly recommends left hand threads be implemented. The spin environment of the projectile along with the left hand threads will ensure that the S&A will remain in the position intended, and avoids the possibility of loose assemblies due to firings.

4. The results of the upside down burster should not be ignored and should be further analyzed by CRDEC. This office feels that the upside down burster results gave an indication that the design and manufacturing of the burster is the main source of the problem.

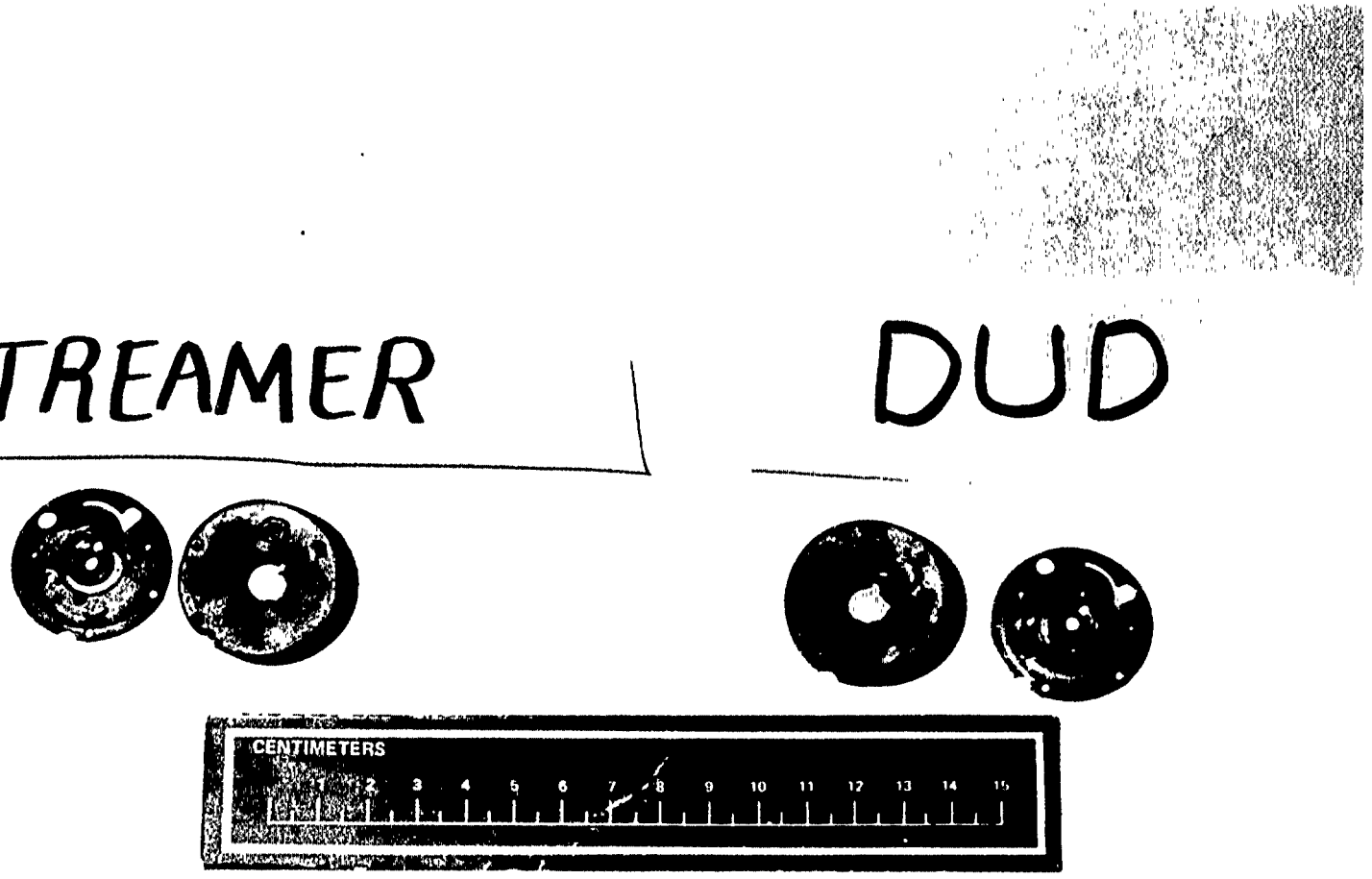

Figure 1. M739/M739A1 recovered safe and arm, M825A1 assembly

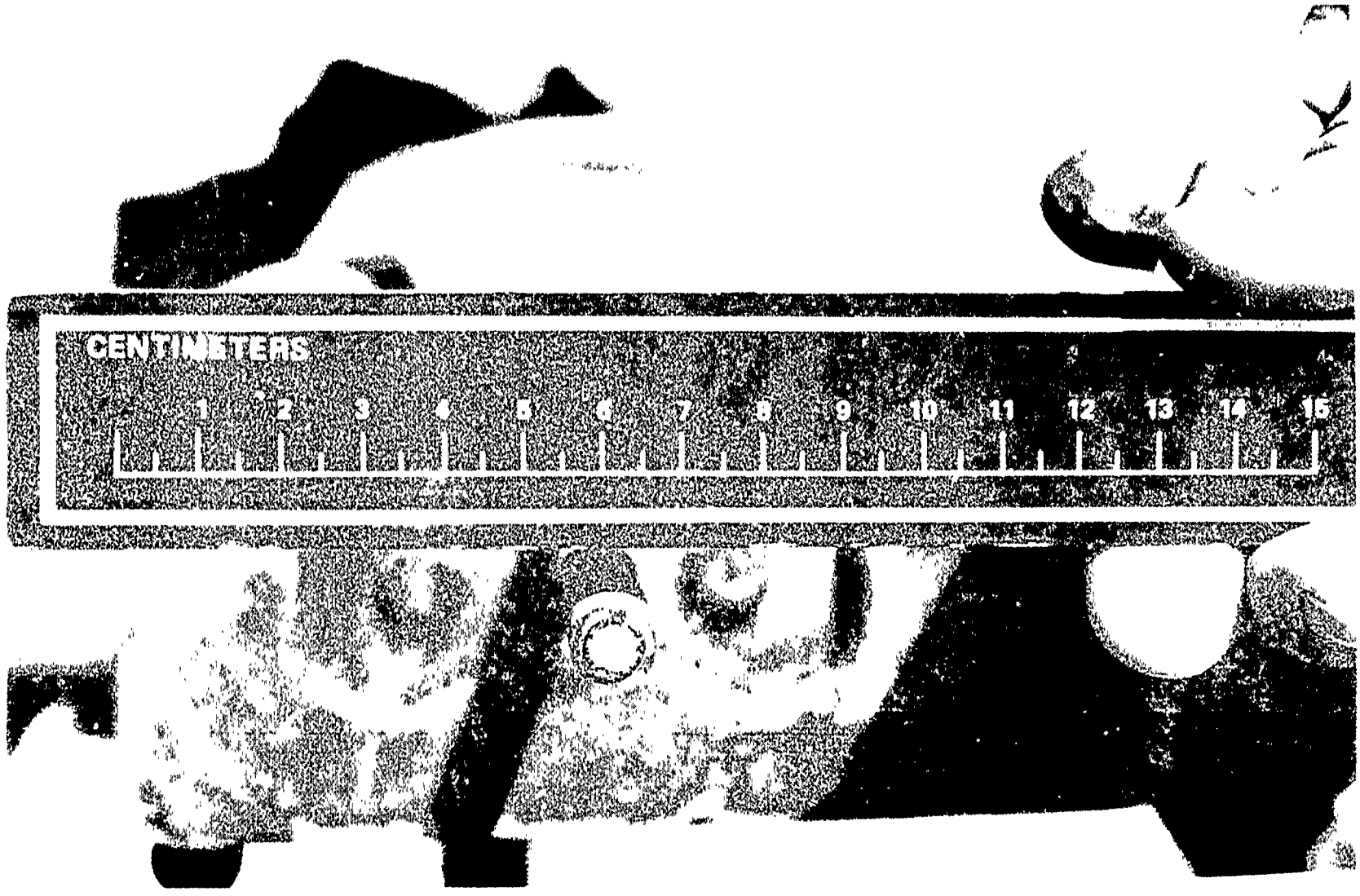

Figure 2. M825A1 recovered burster, lot PB-89J000E005

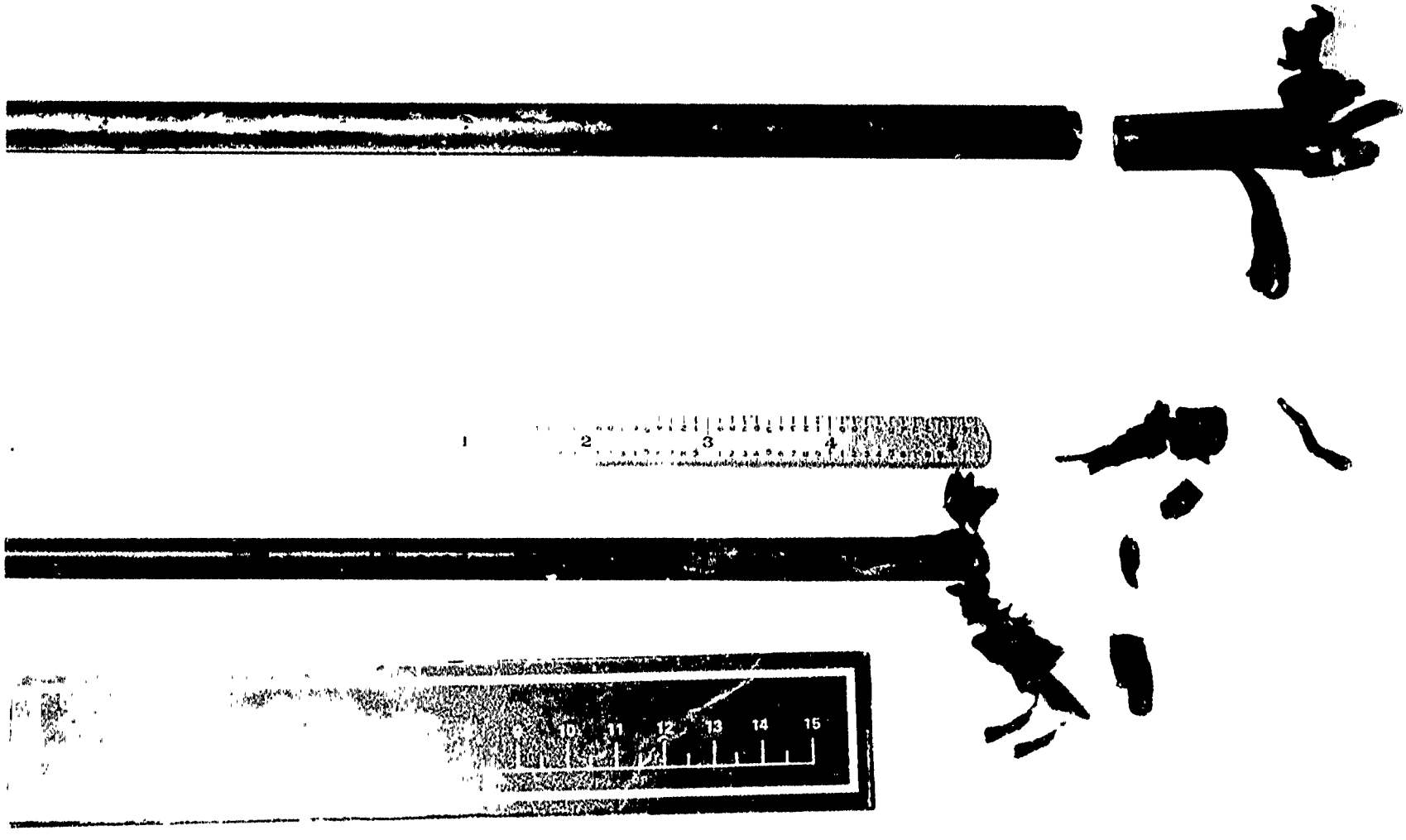

Figure 3. Damage on recovered dud, M825A1, lot PB-89J000E005

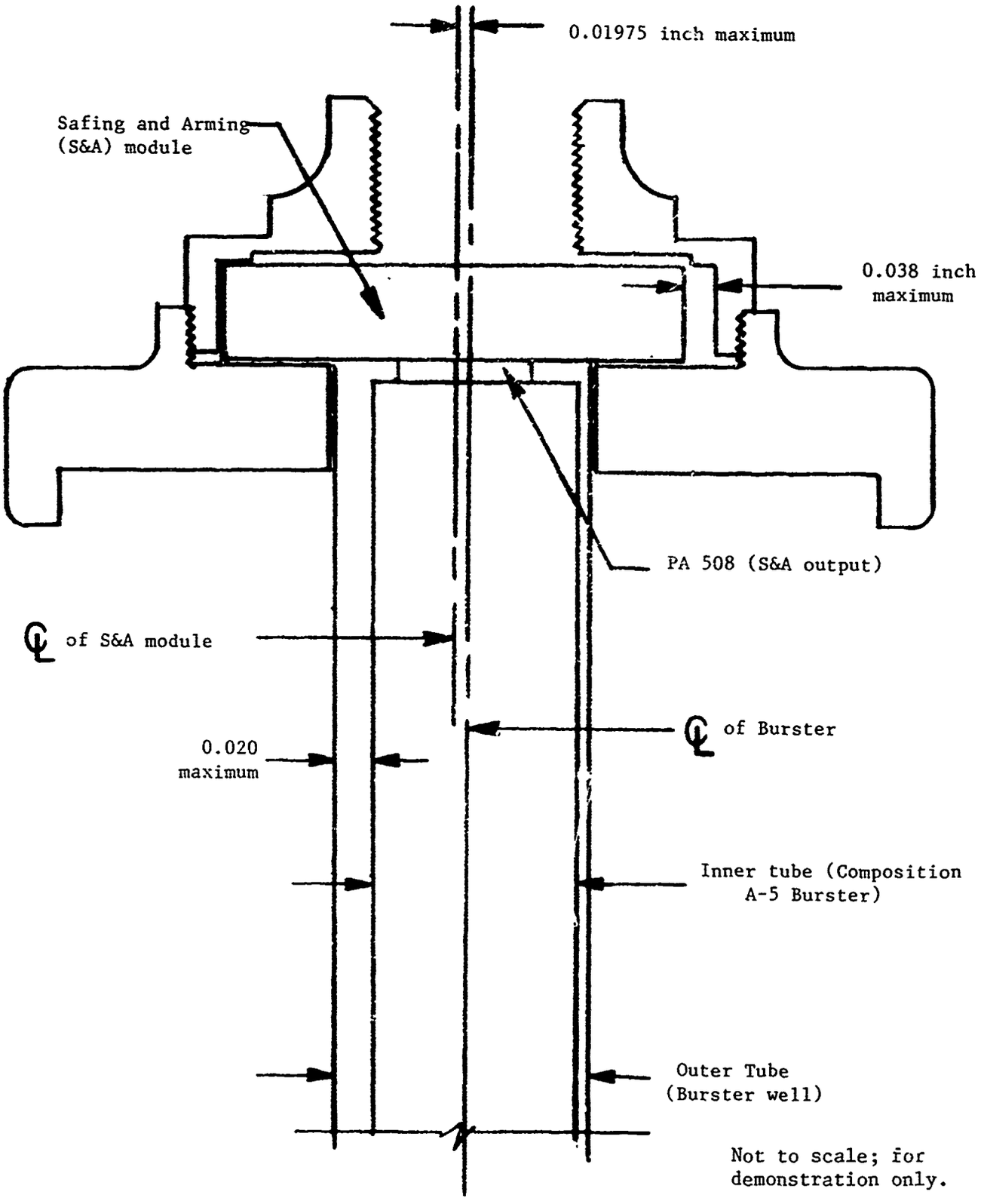

Figure 4. Horizontal tolerance M825/M825AI assembly

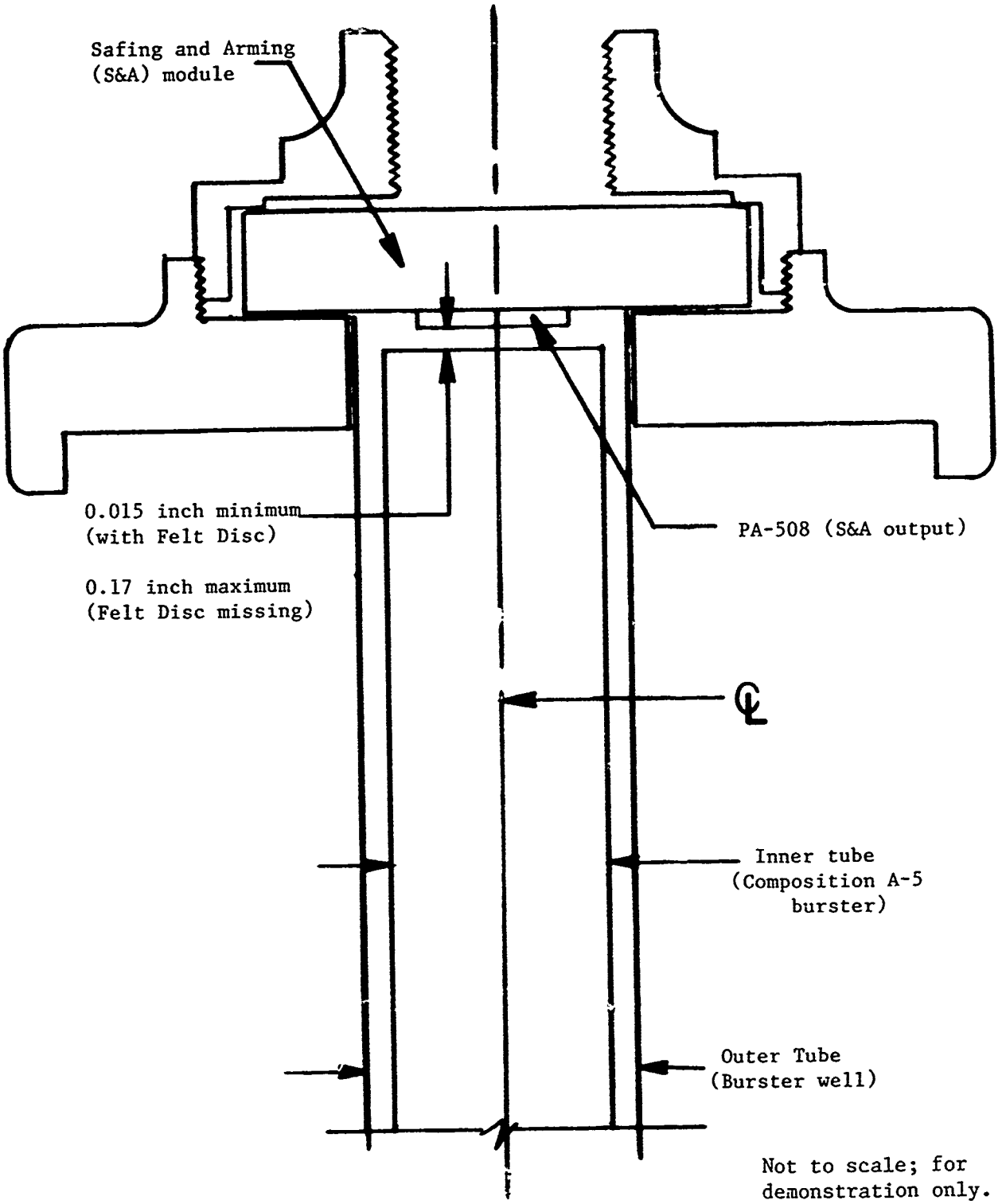

Figure 5. Vertical tolerance M825/M825A1 assembly

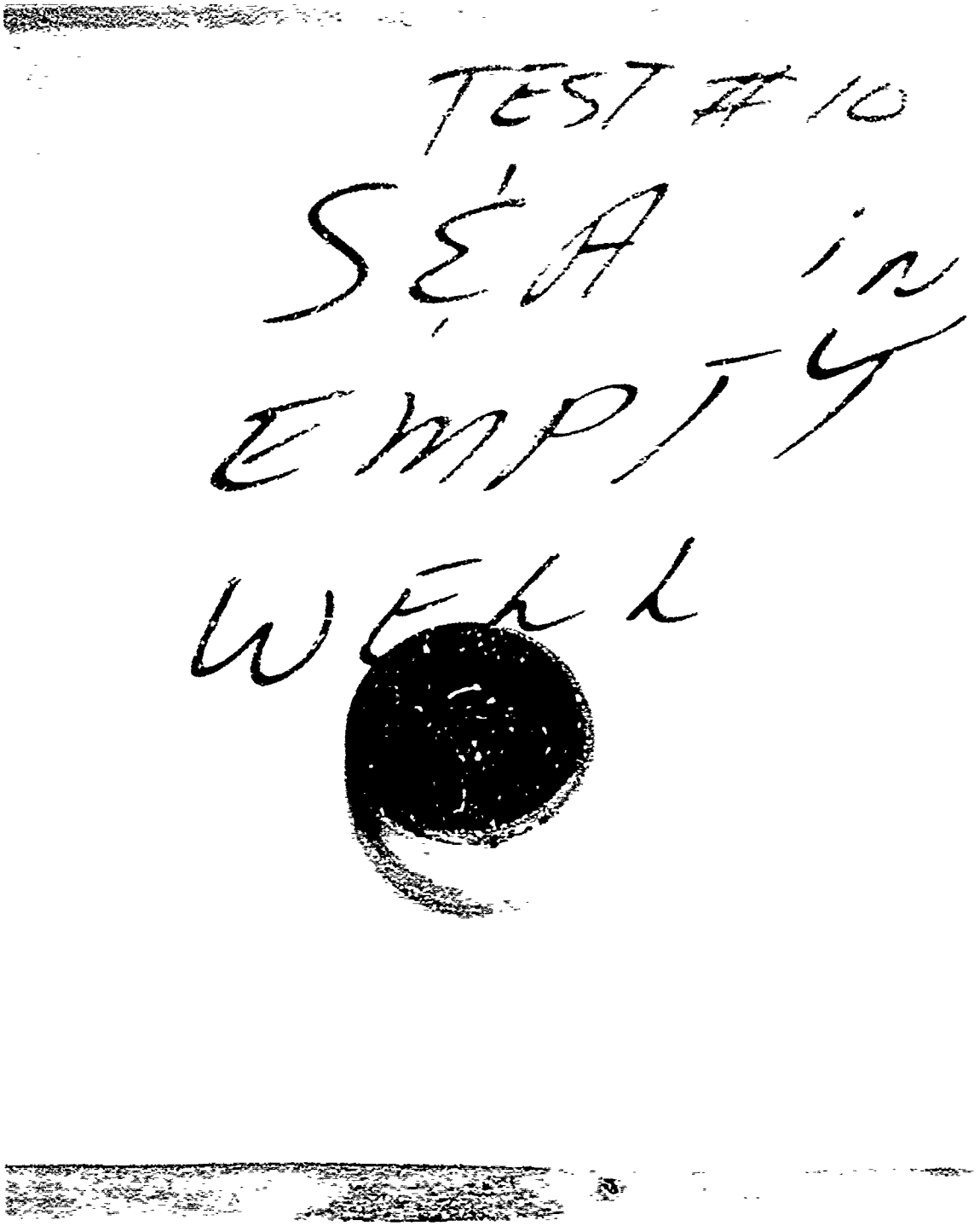

Figure 6. M739/M739A1 safe and arm in empty well M825A1 assembly

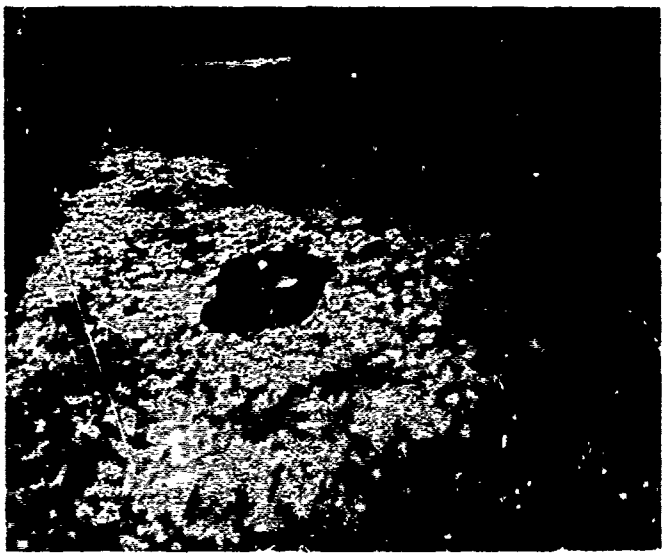

Figure 7. M739/M739A1 safe and arm upside down M825A1 assembly, after test, sideview

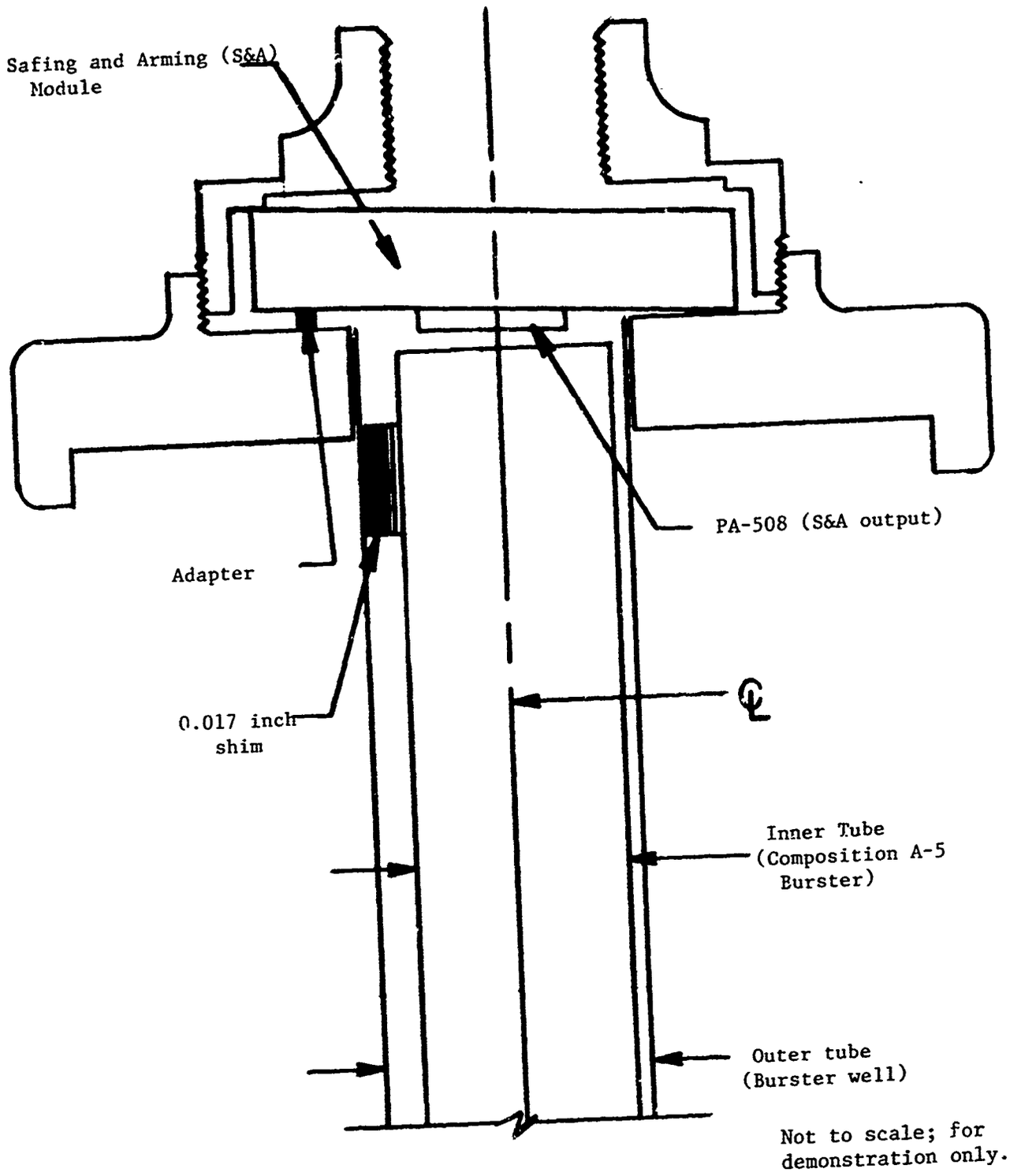

Figure 8. Cocked safing and arming M825/M825A1 assembly

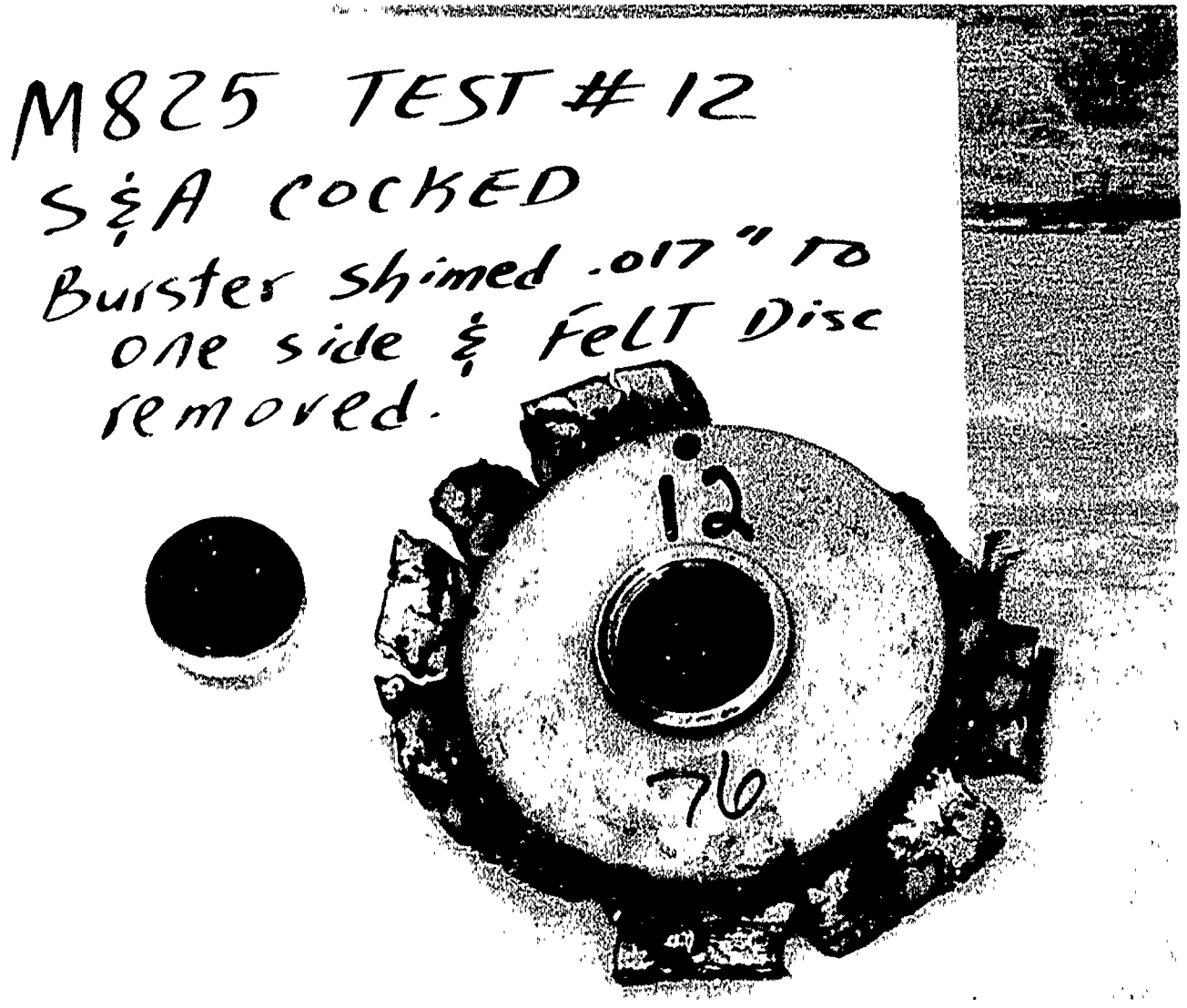

Figure 9. Cocked M739/M739A1 safe and arm, M825A1 assembly

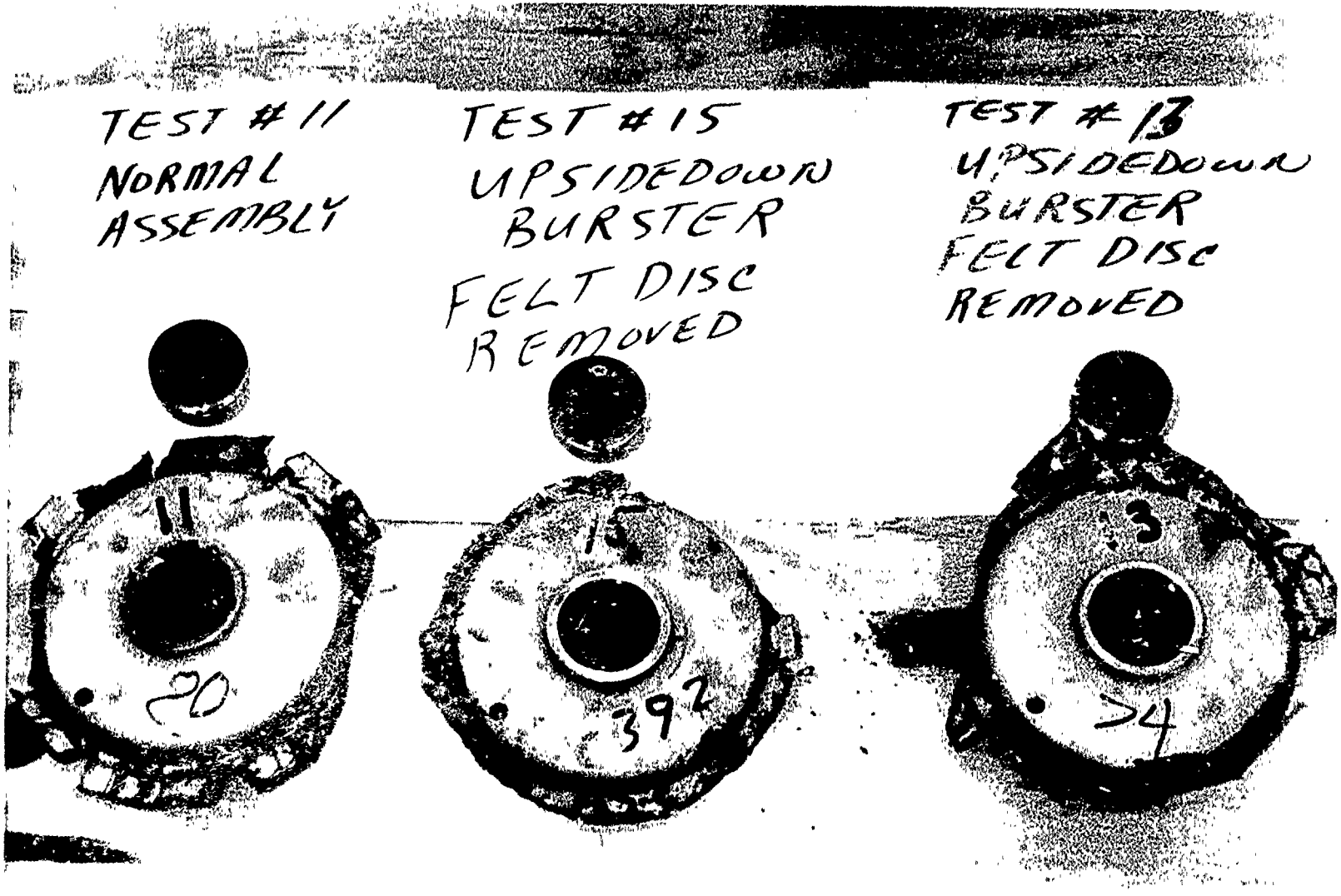

Figure 10. Damage comparison M825A1 assembly upside down burster versus normal assembly

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APPENDIX A

CRDEC SPECIFIED TESTS

DEPARTMENT OF THE ARMY
U.S. ARMY CHEMICAL RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
ABERDEEN PROVING GROUND, MARYLAND 21010-5423

REPLY TO ATTENTION OF

SMCCR-MUS-T

26 APR 1990

MEMORANDUM FOR: Commander, U.S. Army Research Development and Engineering Center, ATTN: SMCAR-AEF-F (S. Koury), SMCAR-AEE-WE (F. Correll), Picatinny Arsenal, NJ 07806-5000

SUBJECT: Static Test of M825 S&A/Front Plate Assembly

1. Examination of recovered "dud" canisters at Dugway Proving Ground, reveal considerable metal damage to the top end of both the burster and burster well for approximately 1.5 - 2.0 inches column length. It is not certain whether or not the missing composition A5 explosive in the short length (1.5 - 2.0 inches) detonated or was blown away, the remaining 16.5 - 17.0 inches of burster contained undetonated A5 material.

2. This confirms our request for ARDEC to add to their Scope of Work (SOW) for M825/M825A1 explosive component testing. The following static test is to help us better assess the explosive train components and hardware from recovered "dud" canisters:

Test No.	Front Plate Assembly	Simulated Burster	Safe & Arms Module
1	From Reject Lot	Alum. Rod w/.070 cavity	From Reject Lot
2	From Reject Lot	Alum. Rod w/.080 "	From Reject Lot
3	From Reject Lot	Alum. Rod w/.090 "	From Reject Lot
4	From Accepted Lot	Alum. Rod w/.070 "	From Accepted Lot
5	From Accepted Lot	Alum. Rod w/.080 "	From Accepted Lot
6	From Accepted Lot	Alum. Rod w/.090 "	From Accepted Lot
7	From Aocepted Lot	Alum. Rod w/.090 "	From Reject Lot
8	From Reject Lot	Alum. Rod w/.070 "	From Accepted Lot

NOTE:

a. Priority of effort is to conduct test numbers 3, 6, 7 and 8 first.

b. S&A should be retained in Front Plate Assembly with the M825 retainer (any lot)

c. Initiate the S&A (M55 stab detonator) with whatever means is appropriate and will work and have on hand to ensure successful test results.

d. Simulated bursters (aluminum rods machined to burster configuration) were hand carried to ARDEC by CRDEC on 26 April 1990 and are in the possession of Mr. S. Koury.

3. My POC for this testing is Mr. Donny W. Bromley, AV 584-2882.

FOR THE COMMANDER:

JOHN M. FERRITER
Acting Director, Munitions

26 APR 1990

SMCCR-MUS-T
SUBJECT: Static Test of M825 S&A/Front Plate Assembly

MEMO FOR RECORD

We had originally planned to conduct these tests at CRDEC. Shipping delivery problems encountered at ARDEC resulted in our decision to leave our sample of reject and accepted explosive components at ARDEC as backup to their explosive work. ARDEC can conduct these tests for us.

DONNY W. BROMLEY

DONALD V. PALUGHI
Acting Dep Dir, Munitions

APPENDIX B

M825A1 FUZE DIVISION TEST DATA, ARDEC

M825A1 FUZE DIVISION TEST DATA

SHEET 1 OF 3

TEST #	FRONT PLATE ASSEMBLY #	FRONT PLATE ASSEMBLY M825 LOT #	BURSTER #	BURSTER LOT #	BURSTER DEPTH	SAFE & ARM #	SAFE & ARM LOT #	SAFE & ARM M825 LOT #	RETAINER HEIGHT (See figure B1) #	A	B	C	D
1	NOT USED		NOT USED			NOT USED			NOT USED				
2	77	PB-89J000E005	A1 rod w/.090 cav		.459	191	AKT-88H001-001	PB-89J000E005	55	.412	.411	.407	.413
3	393	PB-87K008-002	A1 rod w/.090 cav		.471	261	REX-85E001-007	PB-88A008-007	57	.389	.389	.387	.386
4	394	PB-87K008-002	A1 rod w/.090 cav		.455	192	AKT-88H001-001	PB-89J000E005	60	.387	.390	.386	.381
5	78	PB-89J000E005	A1 rod w/.070 cav		.458	262	REX-85E001-007	PB-88A008-007	61	.382	.382	.380	.388
6	71	PB-89J000E005	A1 rod w/.070 cav		.453	193	AKT-88H001-001	PB-89J000E005	62	.380	.384	.381	.384
7	72	PB-89J000E005	A1 rod w/.080 cav		.459	194	AKT-88H001-001	PB-89J000E005	73	.362	.366	.353	.361
8	395	PB-87K008-002	A1 rod w/.070 cav		.460	263	REX-85E001-007	PB-88A008-007	63	.358	.362	.358	.367
9	400	PB-87K008-002	A1 rod w/.080 cav		.456	264	REX-85E001-007	PB-88A008-007	64	.356	.358	.354	.363
10	73	PB-89J000E005	NOT USED			265	REX-85E001-007	PB-88A008-007	65	.366	.361	.364	.370
11	80	PB-89J000E005	10	AMN-86H002-002	AB FL	195	AKT-88H001-001	PB-89J000E005	67	.363	.366	.361	.365
12	76	PB-89J000E005	6	AMN-86H002-002	.436	196	AKT-88H001-001	PB-89J000E005	58	.492	.493	.490	.495
13	74	PB-89J000E005	17	AMN-86H002-002	.447	197	AKT-88H001-001	PB-89J000E005	59	.379	.373	.379	.372
14	75	PB-89J000E005	18	AMN-86H002-002	AB FL	198	AKT-88H001-001	PB-89J000E005	70	.416	.422	.442	.427
15	392	PB-87K008-002	7	AMN-86H002-002	.450	199	AKT-88H001-001	PB-89J000E005	69	.363	.367	.363	.358
16	79	PB-89J000E005	NOT USED			200	AKT-88H001-001	PB-89J000E005	77	.594	.589	.582	.588
17	NOT USED		NOT USED			198	AKT-88H001-001	PB-89J000E005	68	Not Applicable			
	365												

Notes:

*	All Bursters used were from M825 Lot # PB89J000E005
**	All Retainers were from M825 Lot # PB-89J000E005
***	All Delays used were from M825 Lot # PB88A008-007
AB FL	ABOVE FLUSH

M825A1 FUZE DIVISION TEST DATA

SHEET 2 OF 3

TEST #	DELAY #	COMMENTS	SAFE & ARM OUTPUT HOLE AFTER TEST (See fig B2) A	B	FRONT PLATE ASSEMBLY HOLE AFTER TEST (See fig B3) A	B
1	284	To see if a M1A1 Squib will initiate the Delay				
2	283		.269	.326	.207	.247
3	282		.322	.306	.272	.226
4	281		.338	.362	.256	.239
5	280		.356	.312	.266	.276
6	279		.407	.319	.265	.250
7	278		.326	.240	.273	.260
8	277		.348	.328	.268	.281
9	276		.359	.352	.379	.252
10	275		.318	.336	.323	.333
11	274	Normal assembly	.525	.496	.437	.390
12	273	Felt removed, .017" shim to side, S&A cocked (PA-508 to shim)	.460	.430	.393	.387
13	272	Felt removed, Burster upsidedown	.494	.571	.512	.463
14	271	S&A upsidedown	No hole		.336	.335
15	270	Felt removed, Burster upsidedown	.473	.709	.454	.447
16	269	PA-508 output, 1/8" thick Lead disc (.210 Dia hole/spec)	.448	.407	.331	.331
17	268	To destroy S&A used in test #14.	.353	.404	Not used	
		Unused Front Plate Assembly			.334	.334

Notes:
- * All Bursters used were from M825 Lot # PB89J000E005
- ** All Retainers were from M825 Lot # PB-89J000E005
- *** All Delays used were from M825 Lot # PB88A008-007
- AB FL ABOVE FLUSH

M825A1 FUZE DIVISION TEST DATA

SHEET 3 OF 3

TEST #	REMARKS
1	
2	Alum. rod fused in well.
3	Alum. rod fused in well.
4	Alum. rod fused in well.
5	Alum. rod fused in well.
6	Alum. rod fused in well.
7	Alum. rod fused in well.
8	Alum. rod fused in well.
9	Alum. rod fused in well.
10	No Damage
11	Function High Order, S&A damage identical to DPG recovered.
12	Function High Order
13	Function High Order, sounded louder than other tests.
14	PA-508 did not propigate.
15	Function High Order, sounded louder than other tests.
16	Lead disc hole is .311x.317 (90 Deg apart), spec .210 dia hole, no damage to well.
17	

Notes:

*	All Bursters used were from M825 Lot # PB89J000E005
**	All Retainers were from M825 Lot # PB-89J000E005
***	All Delays used were from M825 Lot # PB88A008-007
AB FL	ABOVE FLUSH

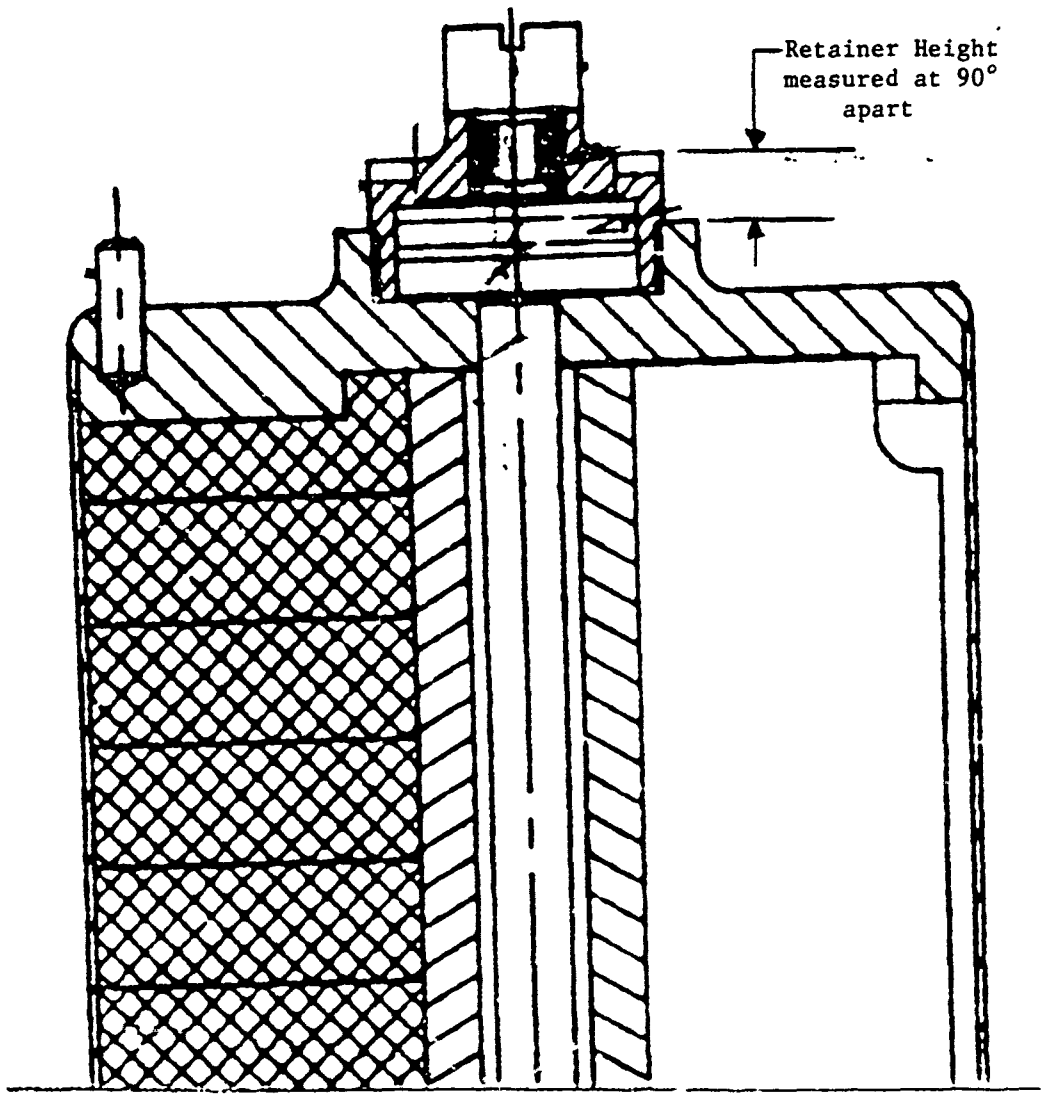


FIGURE B1

Retainer Height
Measurement
M825/M825A1 Assembly

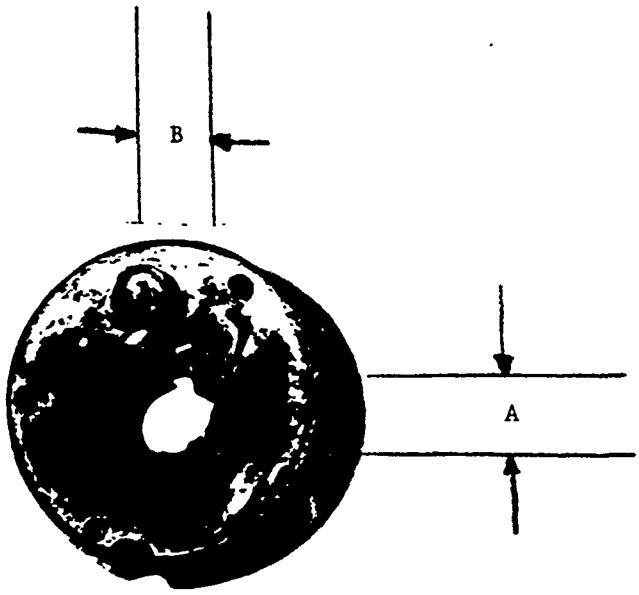
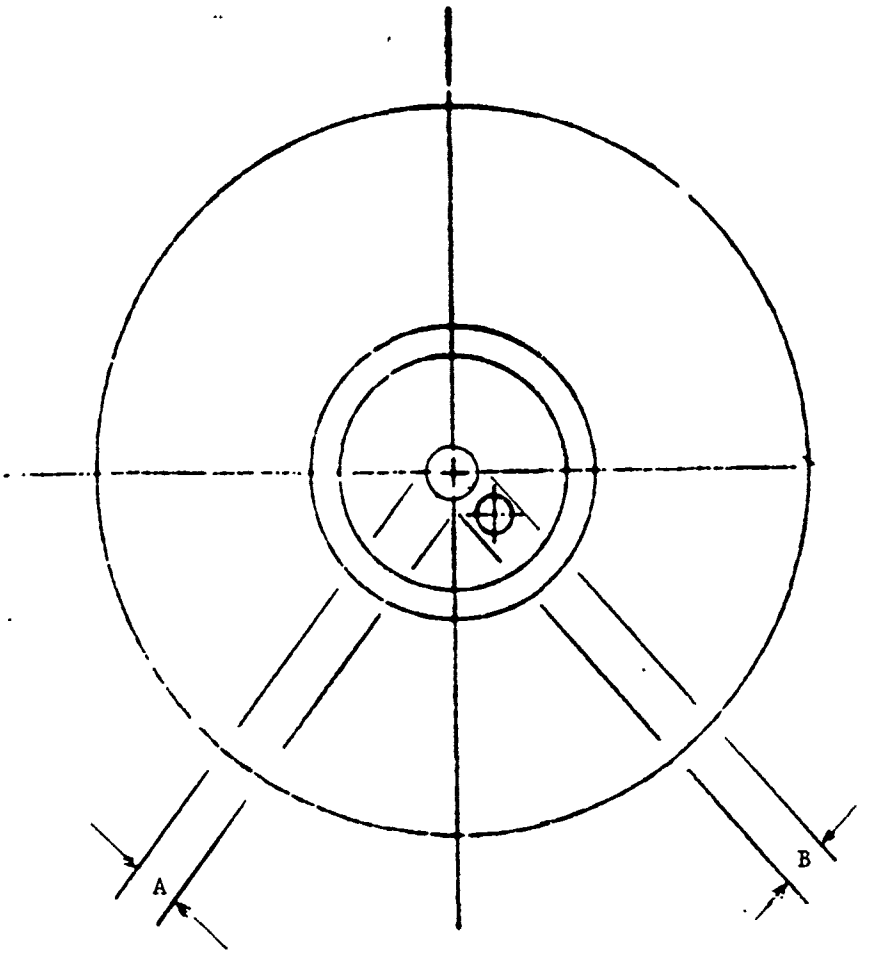


FIGURE B2

M739/M739A1
S&A Output Hole
Dimension Measurement



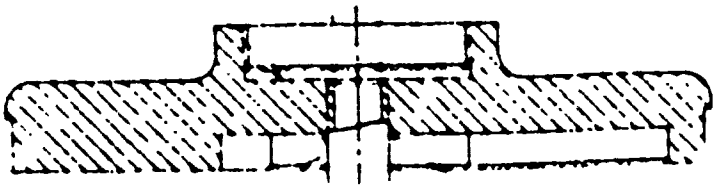


FIGURE B3

M825/M825A1 FRONT PLATE ASSEMBLY
DIMENSION MEASUREMENTS

APPENDIX C

LOT ACCEPTANCE TEST DATA
(PA-508 LEAD)

M825 Smoke Projectile

Ballistic Lot		S&A Lot	Burster Lot
PB-87K008-002		REX-85E001-007	AMN-85D001-010
Pine Bluff	mfg	Rexon Mfg	Action
18 Nov 87	accept	3 May 85	1 Apr 85
	HE	M55	Comp A-5 C-2
	mfg	LS-85C351-063	Expro Chemical
	lot		PCE-2922
	lot	PA508	PCE-2927
	lot	MA-84J003-059	PCE-2928
		Holston Comp A-5	
		HOL83D640-109	
PB-88A008-007		REX-85E001-007	AMN-86D001-021
Pine Bluff		Rexon Mfg	Action Mfg Co
unk		3 May 85	1 Apr 85
			Comp A-5 C-2
			Expro Chemical
			86-035 to 043
PB-89J000-E005		AKT-88H001-001	AMN-86H002-002
Pine Bluff		Action Mfg Co	Action Mfg Co
unk		20 Jan 89	1 Oct 86
		M55	Comp A-5 C-2
		KA-87K356-006	Expro Chemical
			86-044, 045, 073
		PA508	86-074, 076, 077
		MA-87H006-006	86-079, 082, 084
		Holston Comp A-5	86-086
		HOL85L640-277	
		HOL85L640-279	

'C0061 TEST AREA RESULTS FOR:
.EAD.EXPLOSIVE.PA508
.OT NO. ((3)MA-87H006-006) SUB-LOT ( ) QUANTITY (104500)
)ODY LOTS ( ) (

NEXT FUNCTION ( )
COMPLETED DATE (081887)

'EST DESCRIPTIONS:		TST/QTY	RESULTS	TEST	SAM/NO	DEVICE
:UNCTIONING	=1	(150)	(0-FAILURES	(1)	(150)	(OK)
)ATE TEST COMPLETED	=2	(000)	(09/22/87	(2)	( )	(ACC)
	=3	(000)	(	( )	( )	( )
	=4	(000)	(	( )	( )	( )
	=5	(000)	(	( )	( )	( )
			(	( )	( )	( )
			(	( )	( )	( )
			(	( )	( )	( )
			(	( )	( )	( )
			(	( )	( )	( )
			(	( )	( )	( )
			(	( )	( )	( )
			(	( )	( )	( )
			(	( )	( )	( )
			(	( )	( )	( )

'ESTED DATE: (092297) APPROVED BY TWA
JSED DATE: ( ) IN FINISHED ROUND LOT ( )

PIA 508 Lead Assembly

TYPE OF TEST	DISPOSITION	DATE	LOT NO.
Output Test	acceptable	9-22-87	MA-87H006-006

SAMPLE NO.	RESULTS	SAMPLE NO.	RESULTS	SAMPLE NO.	RESULTS	SAMPLE NO.	RESULTS	SAMPLE NO.	RESULTS	SAMPLE NO.	RESULTS
1	OK	26		51		76		101		126	
2		27		52		77		102		127	
3		28		53		78		103		128	
4		29		54		79		104		129	
5		30		55		80		105		130	
6		31		56		81		106		131	
7		32		57		82		107		132	
8		33		58		83		108		133	
9		34		59		84		109		134	
10		35		60		85		110		135	
11		36		61		86		111		136	
12		37		62		87		112		137	
13		38		63		88		113		138	
14		39		64		89		114		139	
15		40		65		90		115		140	
16		41		66		91		116		141	
17		42		67		92		117		142	
18		43		68		93		118		143	
19		44		69		94		119		144	
20		45		70		95		120		145	
21		46		71		96		121		146	
22		47		72		97		122		147	
23		48		73		98		123		148	
24		49		74		99		124		149	
25		50		75		100		125		150	OK

MM-298 (REV 9-72)

INSPECTOR _____

SHOP TEST WORK SHEET

Lead Explosive PA508

TYPE OF TEST	DISPOSITION	DATE	LOT NO.
Functioning output	Accepted	10-2-83	MB-84J003-059

SAMPLE NO.	RESULTS	SAMPLE NO.	RESULTS	SAMPLE NO.	RESULTS	SAMPLE NO.	RESULTS	SAMPLE NO.	RESULTS	SAMPLE NO.	RESULTS
1	OK	26	OK	51	OK	76	OK	101	OK	126	OK
2	↑	27	↑	52	↑	77	↑	102	↑	127	↑
3		28		53		78		103		128	
4		29		54		79		104		129	
5		30		55		80		105		130	
6		31		56		81		106		131	
7		32		57		82		107		132	
8		33		58		83		108		133	
9		34		59		84		109		134	
10		35		60		85		110		135	
11		36		61		86		111		136	
12		37		62		87		112		137	
13		38		63		88		113		138	
14		39		64		89		114		139	
15		40		65		90		115		140	
16		41		66		91		116		141	
17		42		67		92		117		142	
18		43		68		93		118		143	
19		44		69		94		119		144	
20		45		70		95		120		145	
21		46		71		96		121		146	
22		47		72		97		122		147	
23		48		73		98		123		148	
24	↓	49	↓	74	↓	99	↓	124	↓	149	↓
25	OK	50	OK	75	OK	100	OK	125	OK	150	OK

MM-298 (Rev. 6-72)

INSPECTOR _____

APPENDIX D

DESCRIPTION OF THE M825/M825A1 WEAPON SYSTEM

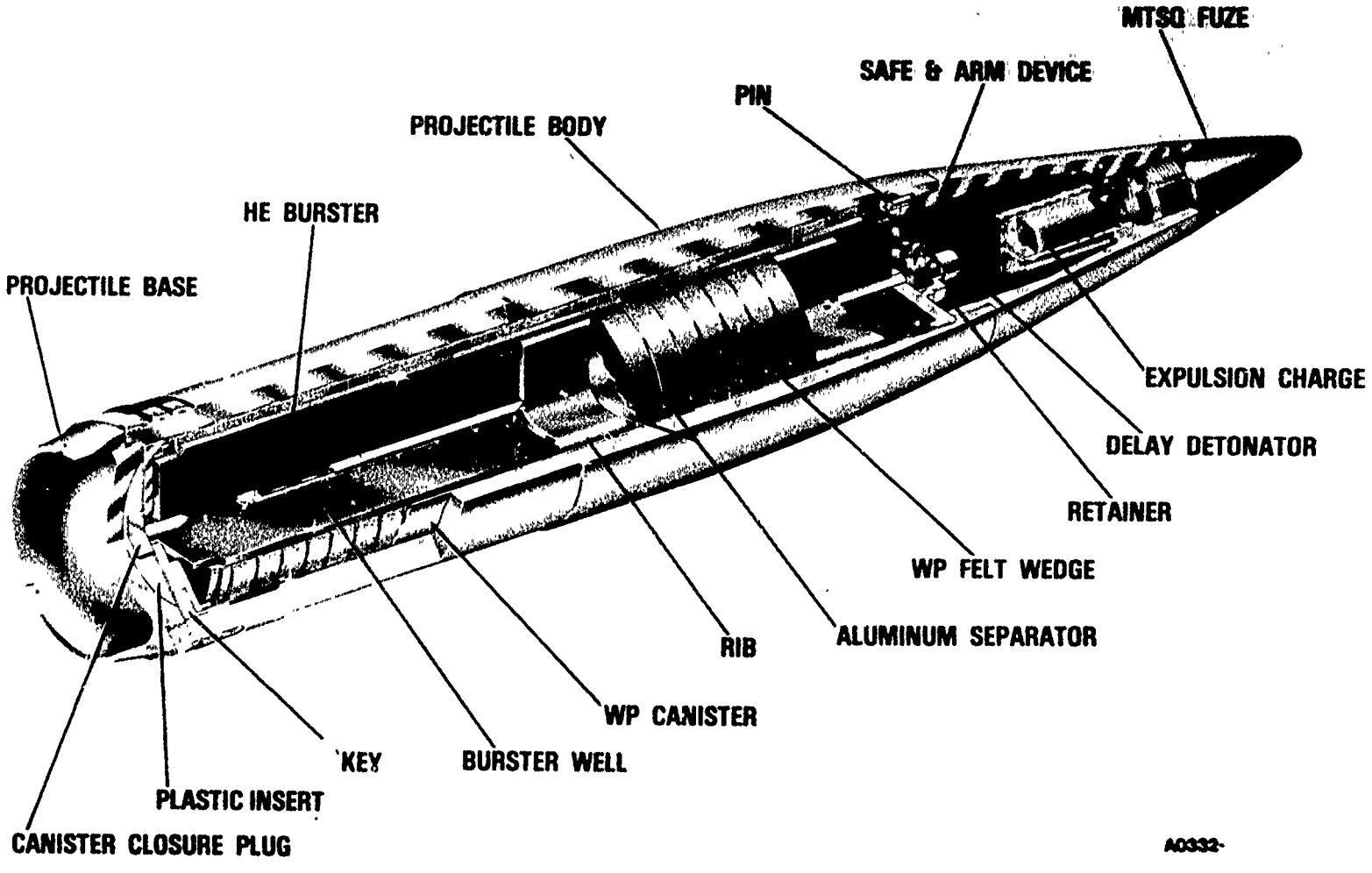
DESCRIPTION OF THE M825/M825A1 WEAPON SYSTEM

The M825/M825A1 is an artillery delivered 155mm projectile which produces a ground screening smoke for five to ten minutes, figure D1. The smoke screen is produced by burning multiple wedge-shaped pieces of felt which have been saturated in WP. The system consists principly of the projectile carrier and the payload (felt wedge WP). The projectile carrier consists of a modified M483A1 steel body and an expulsion charge. The felt wedges are contained in a hermatically sealed canister, in the projectile body.

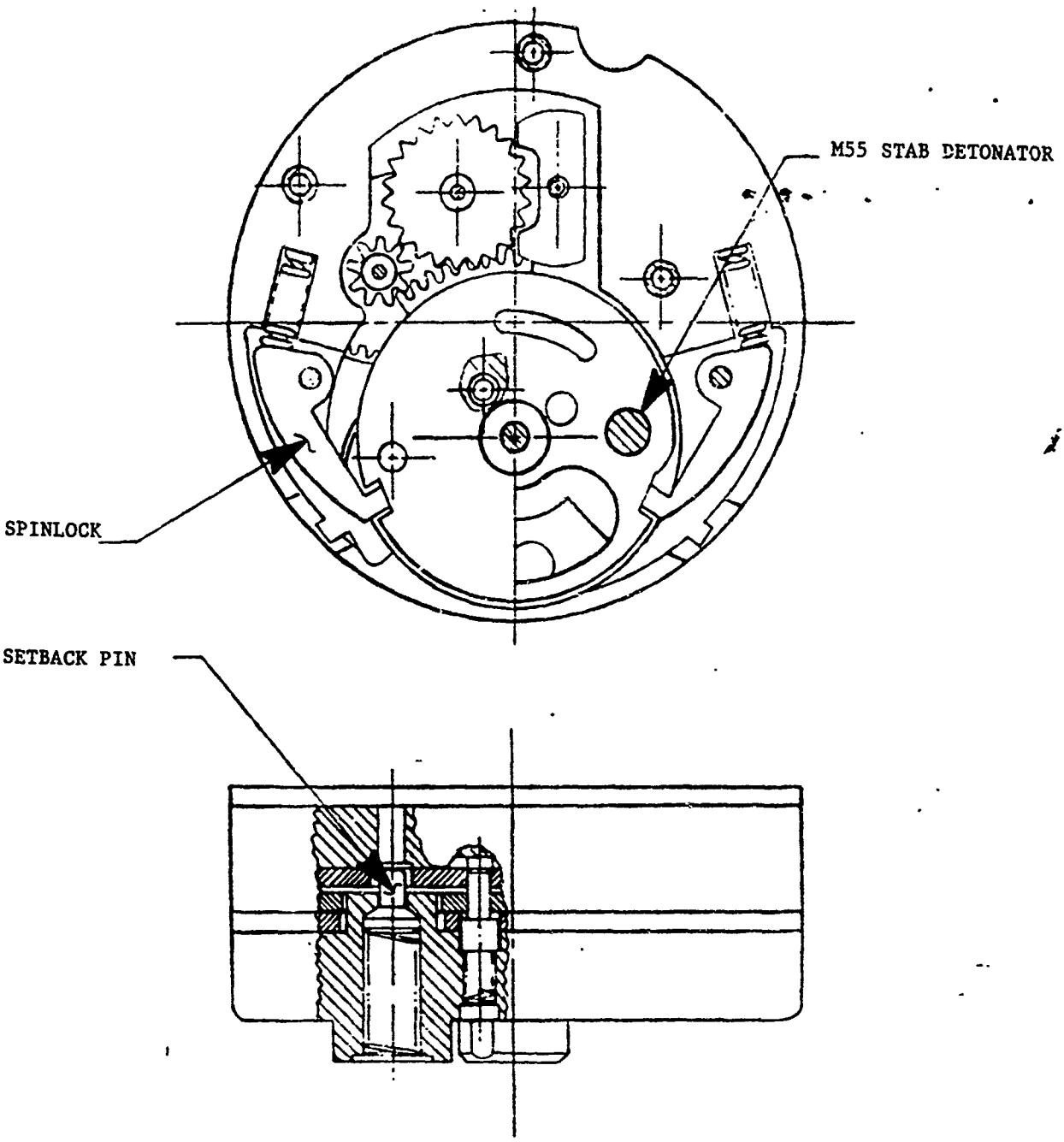
The canister is made of a cylinder of thin rolled steel. Four aluminum angles are arranged in a shape of an asymmetric "X" rib configuration within the canister. This configuration runs the entire length of the canister and divides it into quadrants. A total of one hundred sixteen (116) 3/4 inch thick felt wedges are shaped to conform to the quadrants and are stacked twenty-nine (29) per quadrant.

A burster charge, 1/4 inch diameter (0.1 pounds of Comp A-5), runs the entire length of the canister. The burster is initiated by the M739/M739A1 S&A which is located in the forward end of the main charge below the heat sensitive pyrotechnic delay element.

Upon launch the S&A module arms due to setback and spin. The setback retracts the setback pin while the spin moves the spinlocks outward. Since the safeties have been overcome by setback and spin, the rotor, driven by spin, now turns the M55 stab detonator to inline with the lead (PA-508). The S&A is now armed. A rotor lock pin ensures that the S&A remains armed. Figures D2 to D4 show the arming process of the M739/M739A1 S&A. Even though the M55 is a stab detonator it may also be initiated pyrotechnically. The M55 is initiated by a one hundred (100) milisecond delay that is activated by the burning ogive explusion charge.



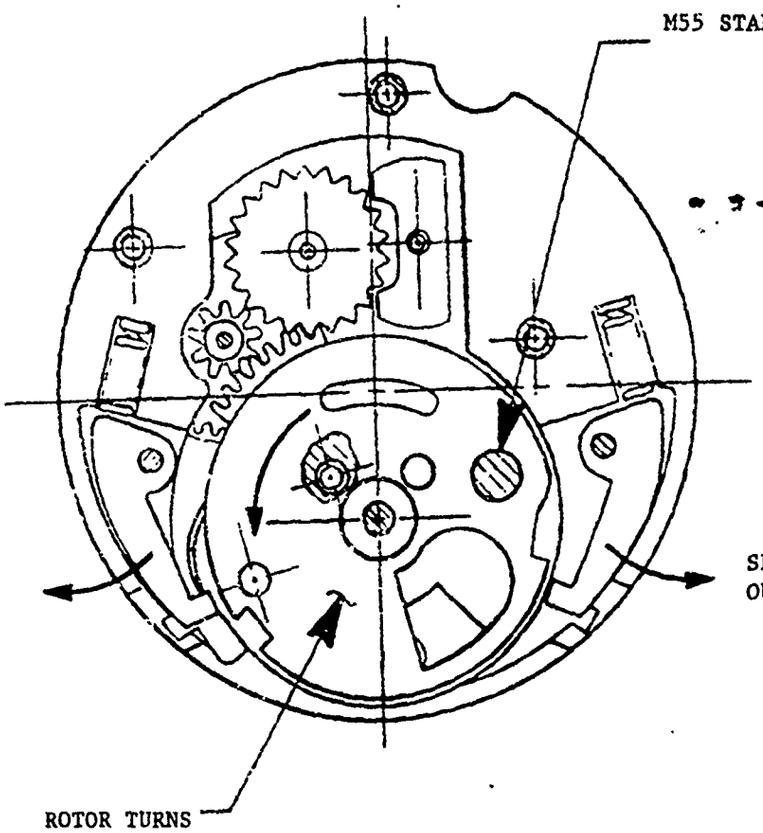
PROJECTILE, 155 MM SMOKE, WP, M825A1
Figure D1



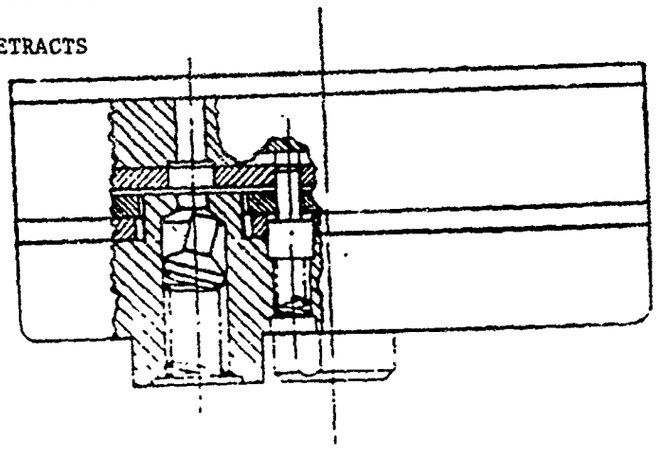
M739/M739A1 SAFING AND ARMING MODULE

FULLY SAFE

FIGURE D2



SETBACK PIN RETRACTS

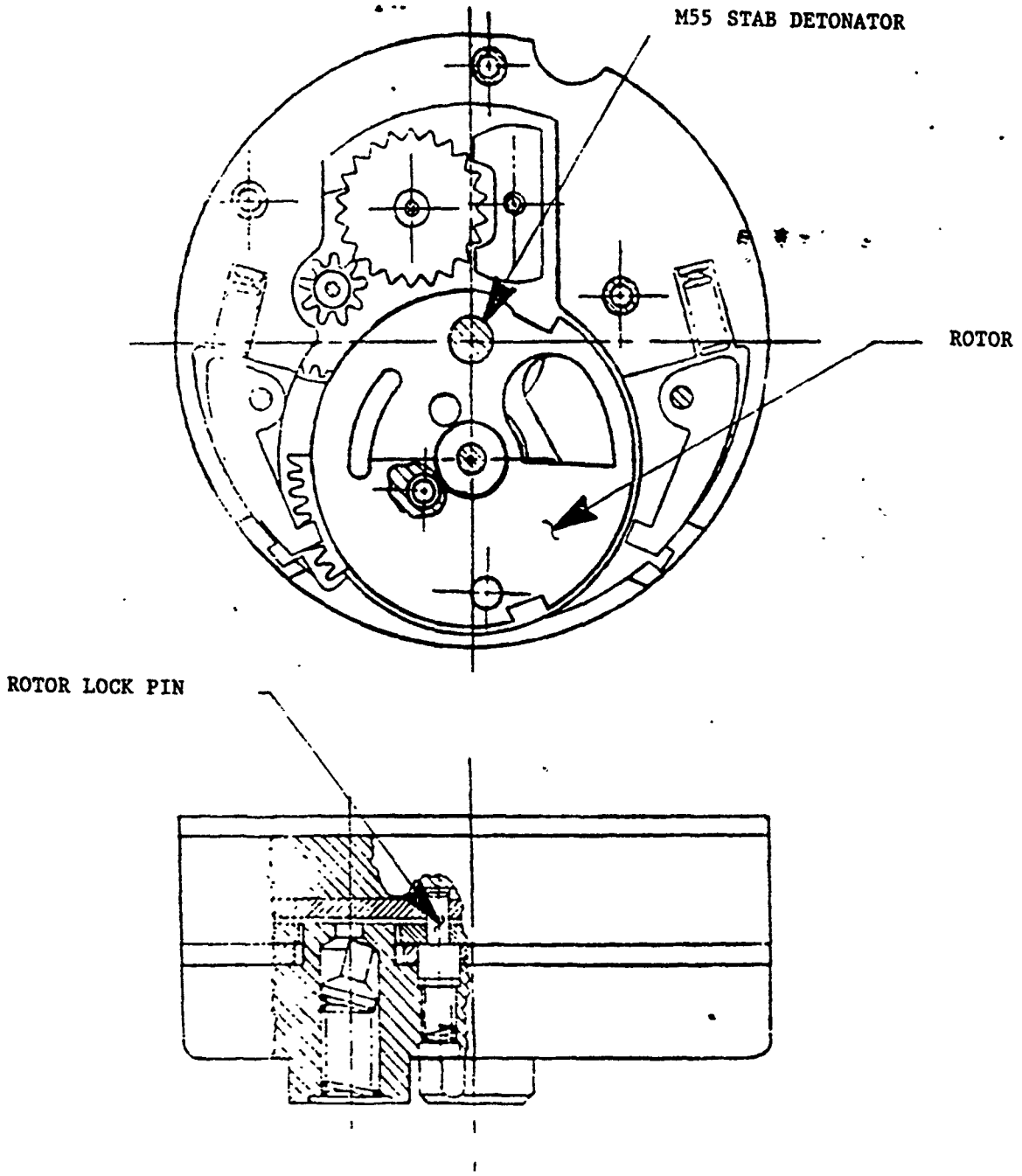


NOTES:
UPON LAUNCH THE SAFING AND ARMING MODULE EXPERIENCES SETBACK AND SPIN. THE SETBACK RETRACTS THE SETBACK PIN WHILE THE SPIN MOVES THE SPIN LOCKS OUTWARD. THE SPIN THEN ROTATES THE ROTOR TO AN ARMED POSITION

M739/M739A1 SAFING AND ARMING MODULE IN FLIGHT

ARMING, IN FLIGHT

FIGURE D3



M739/M739A1 SAFING AND ARMING MODULE
FULLY ARMED IN FLIGHT

FIGURE D4

DISTRIBUTION LIST

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SMCAR-AEF-F (15)
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